## TECHNICAL FIELD

[Field of the Invention]Concerning a bloodless sphygmomanometer in more detail, this invention relates to the bloodless sphygmomanometer which measures a test subject's blood pressure using two cuffs, a hemostasis cuff and a pulse wave detection cuff.

[Translation done.]

## PRIOR ART

[Description of the Prior Art]The conventional general blood-pressure-measurement state is illustrated by drawing 6. Although the seating position state is shown in this, May be the decubitus and a standing position and the test subject's M upper arm part is equipped anyway with the cuff 1, The internal pressure of the cuff 1 is pressurized by the measurement start with the pressurizer in the sphygmomanometer body 2 at urgency to beyond the test subject's M anticipation highest blood pressure value (for example, 150 - 200mmHg) (in the cuff internal pressure change graph of drawing 7, it is A->B).
[0003]After an appropriate time, crawling decompression of the internal pressure of the cuff 1 is carried out by the crawling pressure reducing device in the sphygmomanometer body 2 (B->C of drawing 7). In this crawling pressure reduction process, with the auscultation (the RIBAROTCHI method), cuff internal pressure [ begin ] in which Korotkoff sounds sound is made into a highest blood pressure value (SBP), and cuff internal pressure of the relaxation time point of Korotkoff sounds is made into the lowest-blood-pressure value (DBP).
[0004]On the other hand, in a swing method (oscillometric method), the minute pressure vibration in the cuff 1 in the crawling pressure reduction process of the cuff 1 is detected, and blood pressure is measured. That is, the cuff pressure of the point that the amplitude of that minute pressure vibration serves as the maximum is made into mean blood pressure (MBP), the amplitude at this time is multiplied by a predetermined coefficient, and a highest blood pressure value (SBP) and a lowest-blood-pressure value (DBP) are calculated from a relation with mean blood pressure.
[0005]If a highest blood pressure value and a lowest-blood-pressure value are measured as mentioned above, the compressed air in the cuff 1 will be wide opened quickly by the exhaust in the sphygmomanometer body 2 (C->D of drawing 7). Although he is trying to control the internal pressure of the cuff 1 by this example with the sphygmomanometer body 2, when using the wobble pump by a rubber bulb as a pressurization source, it becomes the same procedure as the above.

[Translation done.]

## TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, since [ of the auscultation and a swing method ] the internal pressure of a cuff is raised anyway more than needed at the measurement start time, unnecessary insecurity and pain may be given to a test subject.
[0007]Decompression of constant speed is difficult by the compliance (elastic coefficient) of a cuff, the air capacities in a cuff, the structure of a crawling pressure reducing device, etc. For example, decompression speed becomes quick, so that early cuff internal pressure is high, and decompression speed becomes slow, so that early cuff internal pressure is low. For this reason [ especially ], in a person with a later heartbeat, an error of measurement becomes large at the time of highest-blood-pressure specification.
[0008]When judging a lowest-blood-pressure value in the auscultation, in 'JNC V' (the 5th U.S. joint committee report), are considering it as the 5th point of Korotkoff sounds, but. While there is a place where the standards, such as using the 4th point according to a test subject's condition, are ambiguous, in the process in which Korotkoff sounds disappear, it is easily influenced by the surrounding noise.
[0009]Although this point and a swing method are methods of specifying only mean blood pressure theoretically and it is strong by the surrounding noise, since a peak magnitude point (MAP) changes with the capacity variations in a cuff in spite of the same blood pressure value, it serves as an error of measurement. Since minute pressure vibration occurs in a cuff even if cuff internal pressure is beyond a highest blood pressure value, specification of a highest blood pressure value is difficult.
[0010]Were made in order that this invention might solve the problem which the device has such conventionally, and the purpose, It is in providing the bloodless sphygmomanometer which enabled it to measure a highest blood pressure value and a lowest-blood-pressure value with sufficient accuracy, without [ without it is based on any of the auscultation or a swing method, and ] performing application of pressure more than needed to a test subject.

[Translation done.]

* NOTICES *



## MEANS

[Means for Solving the Problem]In [ in order to attain the above-mentioned purpose ] this invention, A hemostasis cuff which has a pressurizing valve and an exhaust valve and with which predetermined regions, such as a test subject's upper arm or a finger, are equipped, A pressurization source which supplies pressurized fluid to the above-mentioned hemostasis cuff via the above-mentioned pressurizing valve, and a pressure sensor which detects internal pressure of the above-mentioned hemostasis cuff, A pulse wave extracting circuit which extracts a detection cuff with which the above-mentioned test subject's peripheral part side is equipped, and which detects a pulse wave from an artery rather than the above-mentioned hemostasis cuff, and its pulse wave as an electrical signal, A control means containing a straight-line pressurization value generating part which generates a linear application-of-pressure reference value per predetermined time, It is characterized by having a comparator which compares internal pressure and the above-mentioned application-of-pressure reference value of the above-mentioned hemostasis cuff detected with the above-mentioned pressure sensor, carrying out opening and closing control of the above-mentioned pressurizing valve and the above-mentioned exhaust valve by the above-mentioned comparator, and making it internal pressure of the above-mentioned hemostasis cuff increase linearly based on the above-mentioned application-of-pressure reference value.
[0012]Thus, a test subject's blood pressure can be measured with sufficient accuracy, without being influenced by comp run ANSU, cuff inner capacity, etc. of a cuff by making internal pressure of a cuff increase from a measurement start time linearly. Even when it is a test subject at the hypertension and low-blood-pressure time, the error of measurement will become the same.
[0013]According to the above-mentioned composition, in a process to which internal pressure of a hemostasis cuff is made to increase linearly, a pulse wave signal from a pulse wave extracting circuit can be supervised, and a highest blood pressure value can be judged with internal pressure of a hemostasis cuff at the time of the pulse wave signal disappearing. Therefore, it is not necessary to perform application of pressure more than needed to a test subject.
[0014]In this case, it asks for a test subject's heart rate with a pulse wave signal from a pulse wave extracting circuit, it is preferred to set up an application-of-pressure reference value of straight-line application of pressure according to the number of same mind beats, and according to this, it becomes possible to perform exact blood pressure measurement according to individual difference.
[0015]According to the above-mentioned composition, internal pressure of the above-mentioned hemostasis cuff corresponding to a pulse wave signal and the pulse wave signal to a relaxation time point of a pulse wave signal which are extracted from a measurement start time in a pulse wave extracting circuit is memorized, A lower envelopment curve which connects a minimum level value of each pulse wave signal can judge with a test subject's lowest-blood-pressure value with internal pressure of the above-mentioned hemostasis cuff in a minimum level value of a pulse wave signal of the rise starting point which shows an upward tendency toward a relaxation time point of a pulse wave signal on the whole.

[0016]In calculating a minimum level value of a pulse wave signal of the rise starting point as mentioned above, before pressurizing a hemostasis cuff, a pulse wave for a predetermined heart rate is extracted, It is preferred to compute that amplitude average value (X) and standard deviation (sigma), and to calculate the above-mentioned minimum level value out of this valid data by using a pulse wave of amplitude more than X-3sigma as valid data. The influence can be eliminated even if fluctuation arises by a body motion etc., as a lower envelopment curve shows an upward tendency on the whole according to this.

[0017]

[Embodiment of the Invention]Next, when you understand the technical idea of this invention better, the suitable embodiment is described.

[0018]This bloodless sphygmomanometer is provided with the hemostasis cuff 11 and the detection cuff 12 as illustrated by drawing 1. The hemostasis cuff 11 has the pressurizing valve 13 and the exhaust valve 14, and the air tank 16 which stores the compressed air from the air compressor 15 as a pressurization source is connected to the pressurizing valve 13 via predetermined piping. The pressure sensor 17 which detects the internal pressure is formed in the hemostasis cuff 11. In this example, the thing of the semiconductor differential pressure type [ pressure sensor / 17 ] is used.

[0019]The pulse wave extracting circuit 18 which extracts the pulse wave from a test subject's artery as an electrical signal is connected to the detection cuff 12, and the pulse wave signal is given to CPU(central processing unit) 20 as a control means. The drawing top pressure sensor 17 and CPU20 are made as [ send / to CPU20 / the cuff internal pressure detected with the pressure sensor 17 ], although not connected.

[0020]The linear application-of-pressure reference value per [ to the hemostasis cuff 11 ] predetermined time is set as CPU20 from the final controlling element which is not illustrated. Although about 3 mmHg/s is made suitable, this straight-line ram speed asks for a test subject's heart rate from the pulse wave signal acquired by the pulse wave extracting circuit 18, and is good also as straight-line ram speed of 2 per beat - 3mmHg/.

[0021]This straight-line application-of-pressure reference value is given from CPU20 to the straight-line pressurization value generation circuit 21 as a digital signal. The straight-line pressurization value generation circuit 21 changes the straight-line application-of-pressure reference value into an analog signal, and outputs it to the comparator 22. The comparator 22 compares a straight-line application-of-pressure reference value with the internal pressure signal of the hemostasis cuff 11 from the pressure sensor 17, and it controls the valve-opening close of the pressurizing valve 13 and the exhaust valve 14 so that the internal pressure of the hemostasis cuff 11 increases according to a straight-line application-of-pressure reference value.

[0022]The example of wearing of the hemostasis cuff 11 which is in charge of measuring blood pressure, and the detection cuff 12 is shown in drawing 2. That is, as shown in the figure (a), when equipping a test subject's upper arm part with the hemostasis cuff 11, a twist is also equipped with the detection cuff 12 near the wrist by the side of a tip at it. On the other hand, as shown in the figure (b), when equipping the root side of a finger with the hemostasis cuff 11, as for a twist, the fingertip side by the side of a tip is equipped with the detection cuff 12 at it.

[0023]Thus, if the start key of measurement is pressed after equipping a test subject with the hemostasis cuff 11 and the detection cuff 12, a straight-line application-of-pressure reference value will be given to the comparator 22 via the straight-line pressurization value generation circuit 21 from CPU20. The comparator 22 carries out size comparison of a straight-line application-of-pressure reference value and the cuff internal pressure from the pressure sensor 17, and controls the pressurizing valve 13 and the exhaust valve 14.

[0024]That is, in the case of a cuff internal pressure < straight-line application-of-pressure reference value, the pressurizing valve 13 is made "open", it makes the exhaust valve 14 "close", to this, in the case of a cuff internal pressure > straight-line application-of-pressure reference value, the pressurizing valve 13 is made "close", and it makes the exhaust valve 14 "open." By this valve

control, the internal pressure of the hemostasis cuff 11 increases linearly.

[0025]Thus, if the internal pressure of the hemostasis cuff 11 rises, blood will not flow into a peripheral part eventually and, as a result, the pulse wave signal from the pulse wave extracting circuit 18 will disappear. The relation of a rise and pulse wave signal of this cuff internal pressure is shown in drawing 3, and CPU20 judges with a highest blood pressure value with the cuff internal pressure in the relaxation time point of this pulse wave signal.

[0026]Thus, when a highest blood pressure value is specified, while a measuring finish signal is taken out from CPU20 and pressurizing operation is completed, the exhaust valve 14 is opened wide and the pressure in the hemostasis cuff 11 is quickly returned even to atmospheric pressure. By reference, a series of above-mentioned operation flow charts are shown in drawing 4. Although the highest blood pressure value is specified based on the pulse wave signal from the pulse wave extracting circuit 18 in this example, it is also possible to perform the blood pressure value judging by Korotkoff sounds using a stethoscope or a microphone.

[0027]In this bloodless sphygmomanometer, until a highest blood pressure value is specified as mentioned above from a measurement start point in time, CPU20 memorizes the pulse wave signal acquired from the pulse wave extracting circuit 18 of the detection cuff 12 to the memory area, and he is trying to specify a lowest-blood-pressure value based on the pulse wave signal after [ of a highest blood pressure value ] specific.

[0028]An example of the amplitude waveform of that pulse wave signal is shown in drawing 5, and if the envelope of this pulse wave is seen, fluctuation exists in that upper part and lower part. Although the amplitude for every waveform of a pulse wave is not necessarily constant, about the lower part of a pulse wave, it can be said that the lowest-blood-pressure value is expressed.

[0029]For this reason, when the internal pressure in the hemostasis cuff 11 exceeds a test subject's lowest-blood-pressure value, the lowest-blood-pressure value of the pulse wave in the detection cuff 12 will start a rise in connection with the internal pressure rise of the hemostasis cuff 11. That is, a lowest-blood-pressure value can be specified by specifying the rise starting point P of the lower envelope of this pulse wave, and searching for the internal pressure point Q of the hemostasis cuff 11 at that time.

[0030]Since the highest-blood-pressure point R is already searched for as mentioned above in this invention, Reading the pulse wave signal before this point R from a memory, and going back for every wave, by carrying out size comparison of the value of that lower part, CPU20 specifies the rise starting point P of a lower envelope, and is taken as the lowest-blood-pressure value with the pressure in the hemostasis cuff 11 of that rise starting point P.

[0031]When a body motion occurs in the process in which a lower envelope goes up, from the rise starting point P, fluctuation arises by it in the middle of a rise, and it may become a cause of an error at the time of this specifying a lowest-blood-pressure value.

[0032]So, in computing that amplitude average value (X) and standard deviation (sigma) by extracting the pulse wave for a predetermined heart rate, and specifying the rise starting point P of a lower envelope, before pressurizing the hemostasis cuff 11, be made to let the pulse wave of the amplitude more than X-3sigma be valid data in this example. The influence can be eliminated even if fluctuation arises by a body motion etc., as the lower envelopment curve shows the upward tendency on the whole according to this.

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[Translation done.]

## DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]Concerning a bloodless sphygmomanometer in more detail, this invention relates to the bloodless sphygmomanometer which measures a test subject's blood pressure using two cuffs, a hemostasis cuff and a pulse wave detection cuff.
[0002]
[Description of the Prior Art]The conventional general blood-pressure-measurement state is illustrated by drawing 6. Although the seating position state is shown in this, May be the decubitus and a standing position and the test subject's M upper arm part is equipped anyway with the cuff 1, The internal pressure of the cuff 1 is pressurized by the measurement start with the pressurizer in the sphygmomanometer body 2 at urgency to beyond the test subject's M anticipation highest blood pressure value (for example, 150 – 200mmHg) (in the cuff internal pressure change graph of drawing 7, it is A->B).
[0003]After an appropriate time, crawling decompression of the internal pressure of the cuff 1 is carried out by the crawling pressure reducing device in the sphygmomanometer body 2 (B->C of drawing 7). In this crawling pressure reduction process, with the auscultation (the RIBAROTCHI method), cuff internal pressure [ begin ] in which Korotkoff sounds sound is made into a highest blood pressure value (SBP), and cuff internal pressure of the relaxation time point of Korotkoff sounds is made into the lowest-blood-pressure value (DBP).
[0004]On the other hand, in a swing method (oscillometric method), the minute pressure vibration in the cuff 1 in the crawling pressure reduction process of the cuff 1 is detected, and blood pressure is measured. That is, the cuff pressure of the point that the amplitude of that minute pressure vibration serves as the maximum is made into mean blood pressure (MBP), the amplitude at this time is multiplied by a predetermined coefficient, and a highest blood pressure value (SBP) and a lowest-blood-pressure value (DBP) are calculated from a relation with mean blood pressure.
[0005]If a highest blood pressure value and a lowest-blood-pressure value are measured as mentioned above, the compressed air in the cuff 1 will be wide opened quickly by the exhaust in the sphygmomanometer body 2 (C->D of drawing 7). Although he is trying to control the internal pressure of the cuff 1 by this example with the sphygmomanometer body 2, when using the wobble pump by a rubber bulb as a pressurization source, it becomes the same procedure as the above.
[0006]
[Problem(s) to be Solved by the Invention]However, since [ of the auscultation and a swing method ] the internal pressure of a cuff is raised anyway more than needed at the measurement start time, unnecessary insecurity and pain may be given to a test subject.
[0007]Decompression of constant speed is difficult by the compliance (elastic coefficient) of a cuff, the air capacities in a cuff, the structure of a crawling pressure reducing device, etc. For example, decompression speed becomes quick, so that early cuff internal pressure is high, and decompression

speed becomes slow, so that early cuff internal pressure is low. For this reason [ especially ], in a person with a later heartbeat, an error of measurement becomes large at the time of highest-blood-pressure specification.
[0008]When judging a lowest-blood-pressure value in the auscultation, in 'JNC V' (the 5th U.S. joint committee report), are considering it as the 5th point of Korotkoff sounds, but. While there is a place where the standards, such as using the 4th point according to a test subject's condition, are ambiguous, in the process in which Korotkoff sounds disappear, it is easily influenced by the surrounding noise.
[0009]Although this point and a swing method are methods of specifying only mean blood pressure theoretically and it is strong by the surrounding noise, since a peak magnitude point (MAP) changes with the capacity variations in a cuff in spite of the same blood pressure value, it serves as an error of measurement. Since minute pressure vibration occurs in a cuff even if cuff internal pressure is beyond a highest blood pressure value, specification of a highest blood pressure value is difficult.
[0010]Were made in order that this invention might solve the problem which the device has such conventionally, and the purpose, It is in providing the bloodless sphygmomanometer which enabled it to measure a highest blood pressure value and a lowest-blood-pressure value with sufficient accuracy, without [ without it is based on any of the auscultation or a swing method, and ] performing application of pressure more than needed to a test subject.
[0011]
[Means for Solving the Problem]In [ in order to attain the above-mentioned purpose ] this invention, A hemostasis cuff which has a pressurizing valve and an exhaust valve and with which predetermined regions, such as a test subject's upper arm or a finger, are equipped, A pressurization source which supplies pressurized fluid to the above-mentioned hemostasis cuff via the above-mentioned pressurizing valve, and a pressure sensor which detects internal pressure of the above-mentioned hemostasis cuff, A pulse wave extracting circuit which extracts a detection cuff with which the above-mentioned test subject's peripheral part side is equipped, and which detects a pulse wave from an artery rather than the above-mentioned hemostasis cuff, and its pulse wave as an electrical signal, A control means containing a straight-line pressurization value generating part which generates a linear application-of-pressure reference value per predetermined time, It is characterized by having a comparator which compares internal pressure and the above-mentioned application-of-pressure reference value of the above-mentioned hemostasis cuff detected with the above-mentioned pressure sensor, carrying out opening and closing control of the above-mentioned pressurizing valve and the above-mentioned exhaust valve by the above-mentioned comparator, and making it internal pressure of the above-mentioned hemostasis cuff increase linearly based on the above-mentioned application-of-pressure reference value.
[0012]Thus, a test subject's blood pressure can be measured with sufficient accuracy, without being influenced by comp run ANSU, cuff inner capacity, etc. of a cuff by making internal pressure of a cuff increase from a measurement start time linearly. Even when it is a test subject at the hypertension and low-blood-pressure time, the error of measurement will become the same.
[0013]According to the above-mentioned composition, in a process to which internal pressure of a hemostasis cuff is made to increase linearly, a pulse wave signal from a pulse wave extracting circuit can be supervised, and a highest blood pressure value can be judged with internal pressure of a hemostasis cuff at the time of the pulse wave signal disappearing. Therefore, it is not necessary to perform application of pressure more than needed to a test subject.
[0014]In this case, it asks for a test subject's heart rate with a pulse wave signal from a pulse wave extracting circuit, it is preferred to set up an application-of-pressure reference value of straight-line application of pressure according to the number of same mind beats, and according to this, it becomes possible to perform exact blood pressure measurement according to individual difference.
[0015]According to the above-mentioned composition, internal pressure of the above-mentioned hemostasis cuff corresponding to a pulse wave signal and the pulse wave signal to a relaxation time

point of a pulse wave signal which are extracted from a measurement start time in a pulse wave extracting circuit is memorized. A lower envelopment curve which connects a minimum level value of each pulse wave signal can judge with a test subject's lowest-blood-pressure value with internal pressure of the above-mentioned hemostasis cuff in a minimum level value of a pulse wave signal of the rise starting point which shows an upward tendency toward a relaxation time point of a pulse wave signal on the whole.
[0016]In calculating a minimum level value of a pulse wave signal of the rise starting point as mentioned above, before pressurizing a hemostasis cuff, a pulse wave for a predetermined heart rate is extracted. It is preferred to compute that amplitude average value (X) and standard deviation (sigma), and to calculate the above-mentioned minimum level value out of this valid data by using a pulse wave of amplitude more than X-3sigma as valid data. The influence can be eliminated even if fluctuation arises by a body motion etc., as a lower envelopment curve shows an upward tendency on the whole according to this.
[0017]
[Embodiment of the Invention]Next, when you understand the technical idea of this invention better, the suitable embodiment is described.
[0018]This bloodless sphygmomanometer is provided with the hemostasis cuff 11 and the detection cuff 12 as illustrated by drawing 1. The hemostasis cuff 11 has the pressurizing valve 13 and the exhaust valve 14, and the air tank 16 which stores the compressed air from the air compressor 15 as a pressurization source is connected to the pressurizing valve 13 via predetermined piping. The pressure sensor 17 which detects the internal pressure is formed in the hemostasis cuff 11. In this example, the thing of the semiconductor differential pressure type [ pressure sensor / 17 ] is used.
[0019]The pulse wave extracting circuit 18 which extracts the pulse wave from a test subject's artery as an electrical signal is connected to the detection cuff 12, and the pulse wave signal is given to CPU(central processing unit) 20 as a control means. The drawing top pressure sensor 17 and CPU20 are made as [ send / to CPU20 / the cuff internal pressure detected with the pressure sensor 17 ], although not connected.
[0020]The linear application-of-pressure reference value per [ to the hemostasis cuff 11 ] predetermined time is set as CPU20 from the final controlling element which is not illustrated. Although about 3 mmHg/s is made suitable, this straight-line ram speed asks for a test subject's heart rate from the pulse wave signal acquired by the pulse wave extracting circuit 18, and is good also as straight-line ram speed of 2 per beat - 3mmHg/.
[0021]This straight-line application-of-pressure reference value is given from CPU20 to the straight-line pressurization value generation circuit 21 as a digital signal. The straight-line pressurization value generation circuit 21 changes the straight-line application-of-pressure reference value into an analog signal, and outputs it to the comparator 22. The comparator 22 compares a straight-line application-of-pressure reference value with the internal pressure signal of the hemostasis cuff 11 from the pressure sensor 17, and it controls the valve-opening close of the pressurizing valve 13 and the exhaust valve 14 so that the internal pressure of the hemostasis cuff 11 increases according to a straight-line application-of-pressure reference value.
[0022]The example of wearing of the hemostasis cuff 11 which is in charge of measuring blood pressure, and the detection cuff 12 is shown in drawing 2. That is, as shown in the figure (a), when equipping a test subject's upper arm part with the hemostasis cuff 11, a twist is also equipped with the detection cuff 12 near the wrist by the side of a tip at it. On the other hand, as shown in the figure (b), when equipping the root side of a finger with the hemostasis cuff 11, as for a twist, the fingertip side by the side of a tip is equipped with the detection cuff 12 at it.
[0023]Thus, if the start key of measurement is pressed after equipping a test subject with the hemostasis cuff 11 and the detection cuff 12, a straight-line application-of-pressure reference value will be given to the comparator 22 via the straight-line pressurization value generation circuit 21 from CPU20. The comparator 22 carries out size comparison of a straight-line application-of-

pressure reference value and the cuff internal pressure from the pressure sensor 17, and controls the pressurizing valve 13 and the exhaust valve 14.

[0024]That is, in the case of a cuff internal pressure < straight-line application-of-pressure reference value, the pressurizing valve 13 is made "open", it makes the exhaust valve 14 "close", to this, in the case of a cuff internal pressure > straight-line application-of-pressure reference value, the pressurizing valve 13 is made "close", and it makes the exhaust valve 14 "open." By this valve control, the internal pressure of the hemostasis cuff 11 increases linearly.

[0025]Thus, if the internal pressure of the hemostasis cuff 11 rises, blood will not flow into a peripheral part eventually and, as a result, the pulse wave signal from the pulse wave extracting circuit 18 will disappear. The relation of a rise and pulse wave signal of this cuff internal pressure is shown in drawing 3, and CPU20 judges with a highest blood pressure value with the cuff internal pressure in the relaxation time point of this pulse wave signal.

[0026]Thus, when a highest blood pressure value is specified, while a measuring finish signal is taken out from CPU20 and pressurizing operation is completed, the exhaust valve 14 is opened wide and the pressure in the hemostasis cuff 11 is quickly returned even to atmospheric pressure. By reference, a series of above-mentioned operation flow charts are shown in drawing 4. Although the highest blood pressure value is specified based on the pulse wave signal from the pulse wave extracting circuit 18 in this example, it is also possible to perform the blood pressure value judging by Korotkoff sounds using a stethoscope or a microphone.

[0027]In this bloodless sphygmomanometer, until a highest blood pressure value is specified as mentioned above from a measurement start point in time, CPU20 memorizes the pulse wave signal acquired from the pulse wave extracting circuit 18 of the detection cuff 12 to the memory area, and he is trying to specify a lowest-blood-pressure value based on the pulse wave signal after [ of a highest blood pressure value ] specific.

[0028]An example of the amplitude waveform of that pulse wave signal is shown in drawing 5, and if the envelope of this pulse wave is seen, fluctuation exists in that upper part and lower part. Although the amplitude for every waveform of a pulse wave is not necessarily constant, about the lower part of a pulse wave, it can be said that the lowest-blood-pressure value is expressed.

[0029]For this reason, when the internal pressure in the hemostasis cuff 11 exceeds a test subject's lowest-blood-pressure value, the lowest-blood-pressure value of the pulse wave in the detection cuff 12 will start a rise in connection with the internal pressure rise of the hemostasis cuff 11. That is, a lowest-blood-pressure value can be specified by specifying the rise starting point P of the lower envelope of this pulse wave, and searching for the internal pressure point Q of the hemostasis cuff 11 at that time.

[0030]Since the highest-blood-pressure point R is already searched for as mentioned above in this invention, Reading the pulse wave signal before this point R from a memory, and going back for every wave, by carrying out size comparison of the value of that lower part, CPU20 specifies the rise starting point P of a lower envelope, and is taken as the lowest-blood-pressure value with the pressure in the hemostasis cuff 11 of that rise starting point P.

[0031]When a body motion occurs in the process in which a lower envelope goes up, from the rise starting point P, fluctuation arises by it in the middle of a rise, and it may become a cause of an error at the time of this specifying a lowest-blood-pressure value.

[0032]So, in computing that amplitude average value (X) and standard deviation (sigma) by extracting the pulse wave for a predetermined heart rate, and specifying the rise starting point P of a lower envelope, before pressurizing the hemostasis cuff 11, be made to let the pulse wave of the amplitude more than X-3sigma be valid data in this example. The influence can be eliminated even if fluctuation arises by a body motion etc., as the lower envelopment curve shows the upward tendency on the whole according to this.

[0033]

[Effect of the Invention]According to this invention, the following effects are done so as explained

above. Namely, a test subject's blood pressure can be measured with sufficient accuracy, without being influenced by comp run ANSU, cuff inner capacity, etc. of a cuff by making the internal pressure of a cuff increase from a measurement start time linearly.

[0034]Even when it is a test subject at the hypertension and low-blood-pressure time, the error of measurement will become the same. Since it is not necessary to perform application of pressure more than needed to a test subject, the pain by bolting can be softened. That is, although shortening of congestion time can be aimed at, measuring time can be further shortened by setting the application-of-pressure initial value as the pressure value considered to be unnecessary. For example, if an application-of-pressure initial value is set to 30mmHg by making a straight-line application-of-pressure reference value into 3 mmHg/s, shortening for 10 seconds will be achieved.

[0035]Not only a highest blood pressure value but a lowest-blood-pressure value can be specified theoretically. When it can measure even if measurement environment is noisy, and especially a lowest-blood-pressure value is specified, before pressurizing a hemostasis cuff, the pulse wave for a predetermined heart rate is extracted, In computing the amplitude average value (X) and standard deviation (sigma), and specifying the rise starting point P of a lower envelope, by using the pulse wave of the amplitude more than X-3sigma as valid data, The influence can be eliminated even if fluctuation arises by a body motion etc., as the lower envelopment curve shows the upward tendency on the whole.

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[Translation done.]

* NOTICES *

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damages caused by the use of this translation.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

## EFFECT OF THE INVENTION

[Effect of the Invention]According to this invention, the following effects are done so as explained above. Namely, a test subject's blood pressure can be measured with sufficient accuracy, without being influenced by comp run ANSU, cuff inner capacity, etc. of a cuff by making the internal pressure of a cuff increase from a measurement start time linearly.
[0034]Even when it is a test subject at the hypertension and low-blood-pressure time, the error of measurement will become the same. Since it is not necessary to perform application of pressure more than needed to a test subject, the pain by bolting can be softened. That is, although shortening of congestion time can be aimed at, measuring time can be further shortened by setting the application-of-pressure initial value as the pressure value considered to be unnecessary. For example, if an application-of-pressure initial value is set to 30mmHg by making a straight-line application-of-pressure reference value into 3 mmHg/s, shortening for 10 seconds will be achieved.
[0035]Not only a highest blood pressure value but a lowest-blood-pressure value can be specified theoretically. When it can measure even if measurement environment is noisy, and especially a lowest-blood-pressure value is specified, before pressurizing a hemostasis cuff, the pulse wave for a predetermined heart rate is extracted, In computing the amplitude average value (X) and standard deviation (sigma), and specifying the rise starting point P of a lower envelope, by using the pulse wave of the amplitude more than X-3sigma as valid data, The influence can be eliminated even if fluctuation arises by a body motion etc., as the lower envelopment curve shows the upward tendency on the whole.

[Translation done.]

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The block diagram showing one example of the bloodless sphygmomanometer of this invention.
[Drawing 2]The explanatory view for explaining the example of wearing to the test subject of the hemostasis cuff in the above-mentioned example, and a detection cuff.
[Drawing 3]The graph which showed the internal pressure rise of the hemostasis cuff in the above-mentioned example, and the relation of the pulse wave signal corresponding to this.
[Drawing 4]The operation flow chart in the case of specifying a highest blood pressure value in the above-mentioned example.
[Drawing 5]The amplitude waveform figure of the pulse wave at the time of specifying a lowest-blood-pressure value in the above-mentioned example.
[Drawing 6]The mimetic diagram showing the conventional general blood-pressure-measurement state
[Drawing 7]The graph which showed the internal pressure change of the cuff in the former.
[Description of Notations]
11 Hemostasis cuff
12 Detection cuff
13 Pressurizing valve
14 Exhaust valve
16 Air tank
17 Pressure sensor
18 Pulse wave extracting circuit
20 CPU
21 Straight-line pressurization value generation circuit
22 Comparator

[Translation done.]

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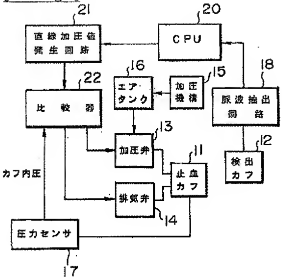
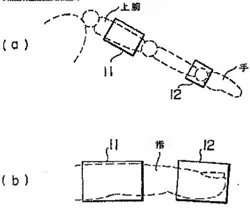
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

## DRAWINGS

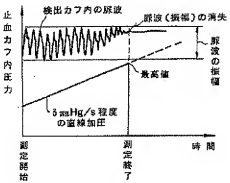
[Drawing 1]



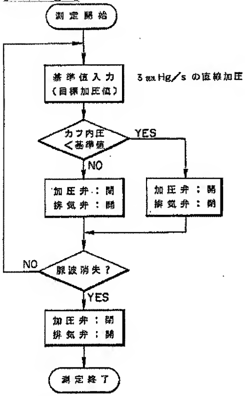

[Drawing 2]



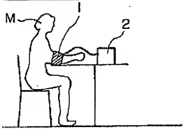

[Drawing 3]



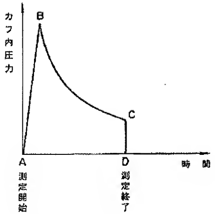

[Drawing 4]



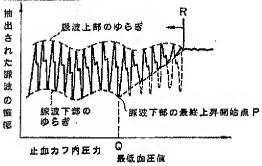

[Drawing 6]




[Drawing 7]




[Drawing 5]




[Translation done.]

## CLAIMS

[Claim(s)]
[Claim 1]It has a comparator characterized by comprising the following which compares a control means with internal pressure and the above-mentioned application-of-pressure reference value of the above-mentioned hemostasis cuff detected with the above-mentioned pressure sensor, A bloodless sphygmomanometer characterized by carrying out opening and closing control of the above-mentioned pressurizing valve and the above-mentioned exhaust valve by the above-mentioned comparator, and making it internal pressure of the above-mentioned hemostasis cuff increase linearly based on the above-mentioned application-of-pressure reference value.
A hemostasis cuff which has a pressurizing valve and an exhaust valve and with which predetermined regions, such as a test subject's upper arm or a finger, are equipped.
A pressurization source which supplies pressurized fluid to the above-mentioned hemostasis cuff via the above-mentioned pressurizing valve.
A pressure sensor which detects internal pressure of the above-mentioned hemostasis cuff.
A straight-line pressurization value generating part which generates a pulse wave extracting circuit which extracts a detection cuff with which the above-mentioned test subject's peripheral part side is equipped, and which detects a pulse wave from an artery rather than the above-mentioned hemostasis cuff, and its pulse wave as an electrical signal, and a linear application-of-pressure reference value per predetermined time.

[Claim 2]The bloodless sphygmomanometer according to claim 1 judging a highest blood pressure value with internal pressure of the above-mentioned hemostasis cuff at the time of the above-mentioned control means supervising a pulse wave signal from the above-mentioned pulse wave extracting circuit, and the pulse wave signal disappearing.
[Claim 3]The bloodless sphygmomanometer according to claim 1, wherein the above-mentioned control means asks for the above-mentioned test subject's heart rate with a pulse wave signal from the above-mentioned pulse wave extracting circuit and sets up the above-mentioned application-of-pressure reference value according to the number of same mind beats.
[Claim 4]The above-mentioned control means memorizes internal pressure of the above-mentioned hemostasis cuff corresponding to a pulse wave signal and the pulse wave signal to a relaxation time point of a pulse wave signal which are extracted from a measurement start time in the above-mentioned pulse wave extracting circuit, A minimum level value of each pulse wave signal. The bloodless sphygmomanometer according to claim 1, wherein a lower envelopment curve to connect judges with the above-mentioned test subject's lowest-blood-pressure value with internal pressure of the above-mentioned hemostasis cuff in a minimum level value of a pulse wave signal of the rise starting point which shows an upward tendency toward a relaxation time point of a pulse wave signal on the whole.
[Claim 5]In calculating a minimum level value of a pulse wave signal of the above-mentioned rise

starting point, before pressurizing the above-mentioned hemostasis cuff, a pulse wave for a predetermined heart rate is extracted, The bloodless sphygmomanometer according to claim 4 computing that amplitude average value (X) and standard deviation (sigma), and calculating the above-mentioned minimum level value out of this valid data by using a pulse wave of amplitude more than X-3sigma as valid data.

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[Translation done.]